****
DISCLOSURE FORM FOLLOWS
****

DOCKET NO. TI_____

1. Please suggest a descriptive title for your invention:
   Advanced IO architecture for Area-efficien
   (cost-efficient) system-on-a chip integration

2. What is the problem solved by your invention?
   Traditional IO architecture (like 18C05's 75x188um2 IO) can cause a wasted die area of 6~13% around IO periphery. The proposed super-short IO architecture utilize the area, hence reducing the silicon area by 6~13% or increase PFO by 6~13% for all WCBU products.

3. What is your solution to the problem?
   1) Please refer to the foil attachment for super-short IO architecture for C035.

   2) Traditional IO: 18C05 WCBU has achieved 75x188um2 IO.
      Proposed IO:
      o proposed the IO buffer/ESD area be next to the bondpad. This type of super-short/super-fat IO utilizes the typical "wasted area" typicall seen in a core-limited design. One possible solution is 108x120um2 C035 IO.

4. When was your solution first conceptually or mentally complete? Date: __/__/__ _/__/___.

5. What is the first tangible evidence of such completion?
   Date: 01/06/99 presentation to Jeff Southard, Jeff Bellay, and briefing to Bobby Mitra.

6. What is different about your solution, compared with other solutions to the same problem?
   1) Traditional IO like 75x188um2 C05 IO grows in the

Y-dimension due to bondpad, ESD, bussing, IO buffer. This wastes silicon area in the IO periphery for any core-limited design.
2) The proposed solution grows in X-dimension for IO buffer and busses in the vertical (M1/M2/M3/M4/M5/...) direction. This approach is especially desirable for 3G air-interface and applications chips where core-limited situation easily dominated due to complexity/functionality increase.
3) The proposed solution also allow a hybrid growth in X- and Y-dimension to match the different core area (vs. IO area) and pin-count situation.

7. What are the advantages of your solution?
1) Save a typicall 2/2.5G/3G wireless chip by area of 6~13% (see attached spreadsheet). This increases the PFO by up to 6~13%.
2) The proposed solution is best optimized for 5-level metal process or more, though not absolutely demanding 5LM.
3) The proposed solution can further reduce the power ring routing typically 50~100um
4) Highly competitive solution which complements process technolog

8. What TI products, processes, projects or operations currently implement your invention?
1) ASIC Backplane in GS40 product
2) All WCBU DBB products starting from GS40: UPP, TIKU, MIMMI, WANDA, OMAP-based, ... etc

9. What is the date of the first implementation?
1st Tapeout:

10. What record exists to prove this date?
Attached PowerPoint file presentation

11. Is there any future implementation planned? (Y/N)
If so, please furnish the TI PART No. or project name
See description in Item 8. above

12. Has the invention been published or disclosed to anyone outside of TI? (Y/N) ____N__ When? _____ If planned - when? _____ (Catalog, advertising, data book, application note, conference paper, magazine article, TI TJ, proposal document.) Was there a nondisclosure agreement (NDA)? (Y/N) _____.

13. Has a TI product incorporating the invention been publicly introduced, quoted, sampled or shipped? (Y/N) __N____ When? _____ If planned--when? _____.

14. Was the invention conceived or first implemented in the performance of a government contract or subcontract? (Y/N)__N____ Contract #: _____

****

THE INVENTION DESCRIBED BY THIS DISCLOSURE IS SUBMITTED PURSUANT TO MY EMPLOYMENT AGREEMENT WITH TEXAS INSTRUMENTS INCORPORATED OR A TI SUBSIDIARY (SPECIFY):

****

Has this disclosure been previously sent to the Patent Department electronically (unsigned)? (Y/N) _____.

(Printed) Inventor 1: Uming Ko_____

Home Address: 2405 Loch Haven Drive_____

Plano, Texas 75023, USA_____
City State Zip County

Emplyoee #: 0186563_____ TI Division & Cost Center 03-0931

Phone #: (972) 480-6788 Country of Citizenship: USA

(Signed) _____ _____ 8723
Date Mail Station

This invention disclosure with any attachments was read and understood by me on _____/ _____/ _____.

Bobby Mitra: _____
Witness 1

Date

This invention disclosure with any attachments was read and understood by me on _____/ _____/ _____.

Jeff Southard:_____ _____

Witness 2 Date

This invention disclosure with any attachments was read and understood by me on _____/ _____/ _____.

Jeff Bellay:
Witness 3 Date

This invention disclosure with any attachments was read and understood by me on _____/ _____/ _____.

Witness 4 Date

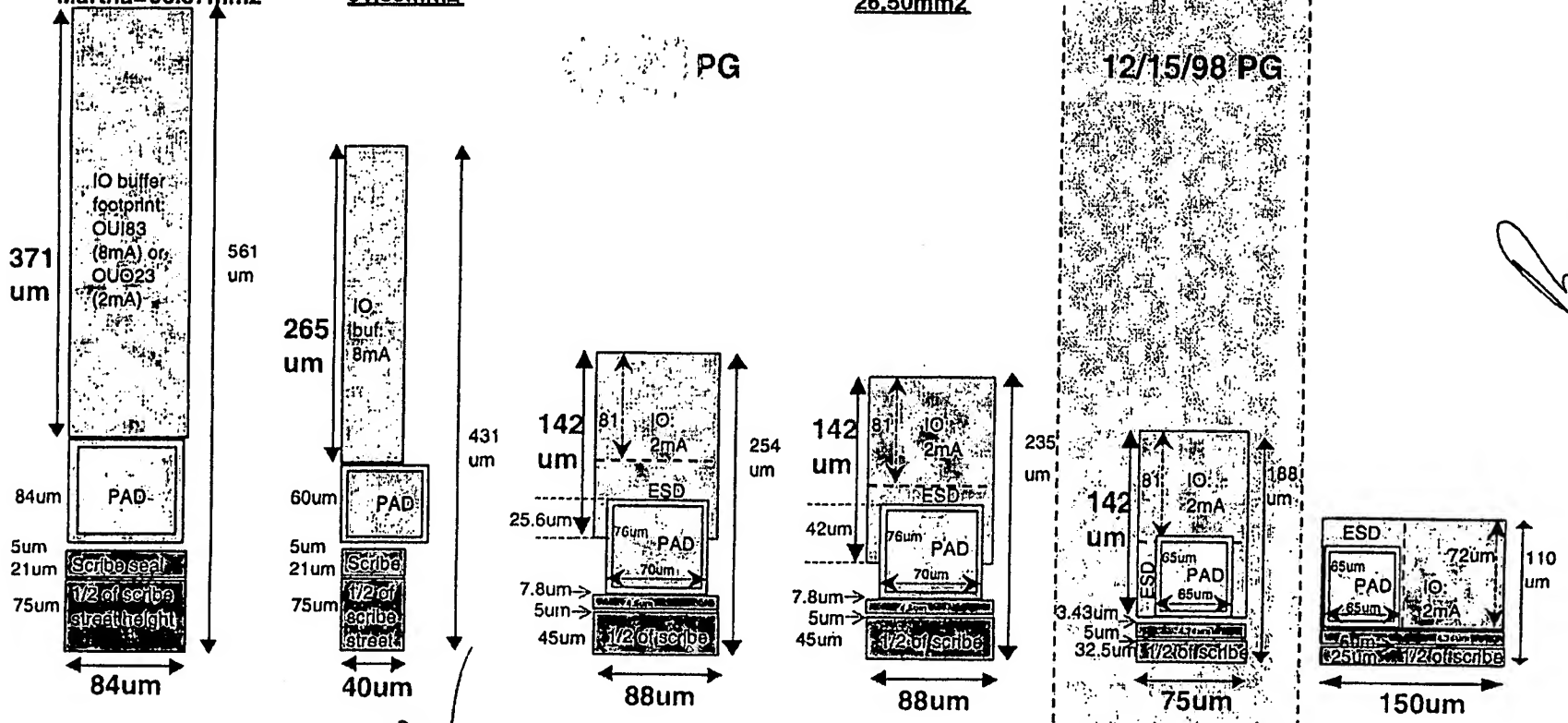
**********END OF FORM**********

WCBU: IO Analysis & Status

C10	C07_ASIC(est)	1833C07	1833C07 Entitlement	1833C05 Entitlement	15C05/C35 Entitlement
MAD2=46.6mm2	23.05mm2	19.2mm2	18.26mm2	WD1=10.7mm2	
Martha=60.57mm2	31.69mm2		26.50mm2		

PG

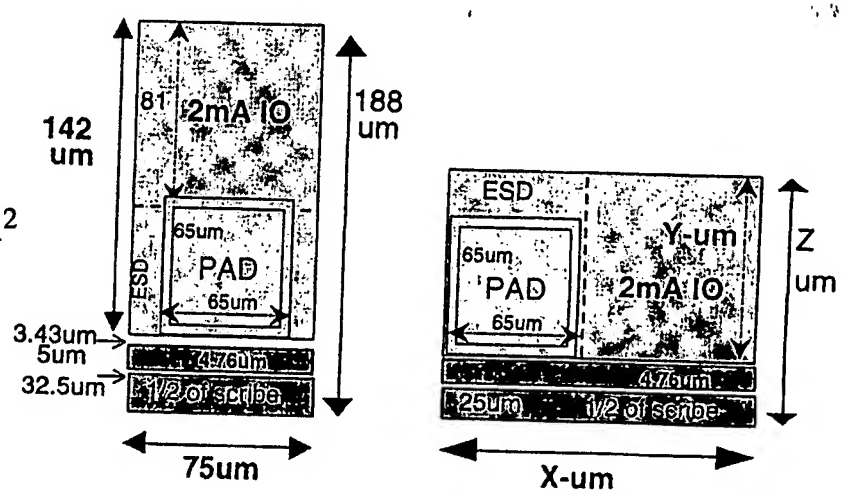
12/15/98 PG



Wireless Communications Business Unit

5LM Optimization Proposal: P.R./IO

- **Power Ring around core:**
  - Eliminate 50~100um ring in 5LM
  - Reduce chip area by x%
- **5LM IO footprint:**
  - Buffer+esd: 75x142µm² ⇨ 150x72µm²
  - BOESD: remains at 100%
  - Seal: remains at 4.76µm
  - Scribe: 75µm ⇨ 60µm
  - Reduce chip area by x%
- **Action**: Wai/Steve/Don to confirm IO footprint feasibility by



C05: X=130, Y=82, Z= 120
C35: X=108, Y=82, Z= 120

Wireless Communications Business Unit

UKO,

Core area,mm2	mm/side	IO type	IO height, um	IO width, um	Area	max IO	wasted area	% of chip
10	3.162	ASIC short IO	212	61	12.9	207	2.45	19%
		WCBU short-fat	188	75	12.5	169	1.67	13%
		WCBU super short-fat	120	108	11.6	117		
20	4.472	ASIC short IO	212	61	24.0	293	3.42	14%
		WCBU short-fat	188	75	23.5	239	2.33	10%
		WCBU super short-fat	120	108	22.2	166		
30	5.477	ASIC short IO	212	61	34.8	359	4.16	12%
		WCBU short-fat	188	75	34.3	292	2.83	8%
		WCBU super short-fat	120	108	32.7	203		
40	6.325	ASIC short IO	212	61	45.5	415	4.78	11%
		WCBU short-fat	188	75	44.9	337	3.26	7%
		WCBU super short-fat	120	108	43.1	234		
50	7.071	ASIC short IO	212	61	56.2	464	5.33	9%
		WCBU short-fat	188	75	55.5	377	3.63	7%
		WCBU super short-fat	120	108	53.5	262		
60	7.746	ASIC short IO	212	61	66.7	508	5.83	9%
		WCBU short-fat	188	75	66.0	413	3.97	6%
		WCBU super short-fat	120	108	63.8	287		